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JAPAN · ECONOMIC · INSTITUTE

JEI REPORT

NO. 28A August 1, 1986

RESEARCH AND DEVELOPMENT IN JAPAN: AN UPDATE

Summary

Japan's research and development effort, which increased at an average annual rate of 17 percent in the first half of the 1970s and 11.7 percent in the second half, has continued to grow at a double-digit average annual rate in the 1980s. Although there has been a great deal of debate about increasing the share of R&D funds allocated to basic research, the greater proportion still is spent on applied research and product development. Also noteworthy is the continuing shift of R&D responsibilities to the private sector, as limited budget growth forces government agencies to target their research monies more carefully.

Overall Outlays

According to data compiled by the Management and Coordination Agency, Japan spent almost Y7.9 trillion ($49.3 billion at Y160=$1.00) on R&D activities in fiscal 1984 (ended March 31, 1985), keeping the growth rate near FY 1983's 10 percent gain (see Table 1). Since this rate was significantly above the expansion of the entire economy, research outlays in relation to gross national product rose that year to 2.6 percent from 2.53 percent. This put Japan quite close in percentage terms to the United States, which spent 2.65 percent of GNP on research activities in calendar 1984.

Private industry continued to account for the lion's share of research spending (65.1 percent), followed by universities (21.8 percent) and research institutes (13.1 percent). In fact, companies have been steadily expanding their share of R&D outlays. During the first half of the 1980s, business-

Table 1: Japan's R&D Expenditures, FY 1980-FY 1984

(in billions of yen and percent)

a. By Organization

Fiscal Year	Companies	Research Institutions	Universities	Total
1980	Y3,142.3	Y763.9	Y1,340.1	Y5,246.2
Change	17.9%	15.7%	6.5%	14.5%
Share	59.9%	14.6%	25.5%	100.0%
1981	3,629.8	906.9	1,445.6	5,982.4
Change	15.5%	18.7%	7.9%	14.0%
Share	60.7%	15.2%	24.2%	100.0%
1982	4,039.0	949.3	1,540.4	6,528.7
Change	11.3%	4.7%	6.6%	9.1%
Share	61.7%	14.5%	23.6%	100.0%
1983	4,560.1	971.0	1,649.6	7,180.8
Change	12.9%	2.3%	7.1%	10.0%
Share	63.5%	13.5%	23.0%	100.0%
1984	5,136.6	1,033.1	1,724.2	7,893.9
Change	12.6%	6.4%	4.5%	9.9%
Share	65.1%	13.1%	21.8%	100.0%

b. By Source

Fiscal Year	Government	Private	Foreign	Total
1980	Y1,465.0	Y3,776.3	Y4.9	Y5,246.2
Change	8.2%	17.0%	36.1%	14.5%
Share	27.9%	72.0%	0.1%	100.0%
1981	1,612.4	4,363.8	6.1	5,982.4
Change	10.1%	15.6%	24.5%	14.0%
Share	27.0%	72.9%	0.1%	100.0%
1982	1,666.2	4,855.5	7.0	6,528.7
Change	3.3%	11.3%	14.8%	9.1%
Share	25.5%	74.4%	0.1%	100.0%
1983	1,721.4	5,451.1	8.2	7,180.8
Change	3.3%	12.3%	17.1%	10.0%
Share	24.0%	75.9%	0.1%	100.0%
1984	1,777.8	6,108.6	7.6	7,893.9
Change	3.2%	12.1%	-7.3%	9.9%
Share	22.5%	77.4%	0.1%	100.0%

Source: Management and Coordination Agency

The JEI REPORT (ISSN 0744-6489) is published weekly for $40 per year by the Japan Economic Institute of America, 1000 Connecticut Avenue, N.W., Washington, D.C. 20036. Second class postage paid at Washington, D.C. POSTMASTERS: Send address changes to JEI, 1000 Connecticut Avenue, N.W., Washington, D.C. 20036.

initiated R&D advanced at an average annual rate of 13.1 percent, while work by universities and research institutes increased by 6.3 percent and 8.9 percent, respectively.

The same trend is reflected in a breakdown of research expenditures by funding source. The private sector underwrote 77.4 percent of research spending in FY 1984 compared with 72 percent in FY 1980. Again, this shift was the result of simple arithmetic: government outlays advanced at only a 5.5 percent average annual pace in this decade's first half, while private funding grew 12.8 percent a year during the same time.

It is also interesting to note the strong growth of foreign-funded research in Japan. Although foreign firms have found it difficult to penetrate Japan's research circles, it is expected that they will continue to build a presence there. Given the numbers involved, it is obvious that foreigners will always play a relatively small role in Japan's overall R&D picture. However, their presence signifies the erosion of the "not invented here" syndrome that has blinded foreigners to Japan's technological contributions.

Private Firms Maintain Hot Pace

The nation's commitment to advanced technology is apparent from the fact that R&D growth is evenly divided throughout industry (see Table 2). Some industries, including nonelectric machinery makers and steel mills, are characterized by a steady growth in research outlays, while others, pharmaceutical companies and manufacturers of fabricated metal products, for example, follow a boom-and-bust pattern. The highs and lows seem to cancel each other out, however, resulting in steady aggregate expansion.

When research outlays are compared to gross sales and pretax profits, Japan's research picture is similar to the United States' (see Table 3). According to Business Week's annual R&D survey, research spending by big U.S. corporations averaged 2.6 percent of sales and 31 percent of pretax profits in 1983, rising to 2.9 percent of sales and 32.7 percent of profits the following year -- a better performance than Japan's based on the sales indicator but nearly identical relative to profits. In terms of the ratio of R&D expenditures to pretax profits, however, Japanese firms in several industries easily outspent U.S. companies. For example, Japanese automotive makers earmarked sums equal to 84.5 percent and 71.8 percent of pretax profits in FY 1983 and FY 1984, while the ratios for U.S. producers came to 61.8 percent in 1983 and 43 percent in 1984. The same situation exists in electronics, precision equipment and pharmaceuticals as well. To be sure, American firms shell out vastly greater absolute sums (General Motors Corp. alone outspends nearly all its Japanese competitors combined), but Japanese companies are clearly putting the goal of advancing technology ahead of advancing profits (see Table 4).

Government Research Slowed by Austerity

Prime Minister Yasuhiro Nakasone's pledge to reduce the budget deficit by holding the line on spending has sharply cut the expansion of government research outlays. After remaining one step behind private industry in both FY 1980 and FY 1981, the growth in government funding slowed to only 3 percent-plus a year in the FY 1982-FY 1984 period -- a rate that was maintained in the

year through April 1986. Although this fiscal year's planned 4.8 percent rise is a distinct improvement, it remains a far cry from the 8-10 percent gains made before Mr. Nakasone's arrival.

Table 2: Japan's R&D Expenditures By Industry, FY 1983-FY 1984

(in billions of yen and percentage change)

	FY 1983		FY 1984	
	Total	Change	Total	Change
Agriculture	Y5.7	20.7%	Y4.8	-15.5%
Mining	15.6	0.2	18.8	20.2
Construction	101.3	25.7	116.1	14.6
Manufacturing	4,257.2	13.4	4,776.5	12.2
Food Products	111.2	5.9	123.7	11.3
Textiles	51.0	-1.6	59.5	16.6
Pulp and Paper	25.7	30.9	29.1	13.3
Publishing and Printing	11.5	42.5	13.9	20.6
Chemicals	774.5	12.7	852.8	10.1
Industrial Chemicals and Synthetic Fibers	297.7	8.9	346.3	16.3
Oils and Paints	75.0	11.8	84.3	12.4
Pharmaceuticals	289.9	20.9	295.3	1.9
Other	112.0	4.5	127.0	13.4
Petroleum and Coal Products	49.8	14.4	56.0	12.3
Plastic Products	51.8	n.a.	64.0	23.5
Rubber Products	57.8	3.5	68.4	18.4
Nonmetallic Mineral Products	113.3	21.0	131.3	15.9
Steel	186.1	1.8	192.1	3.2
Nonferrous Metals	74.0	2.6	87.7	18.5
Fabricated Metal Products	82.8	27.7	83.5	0.8
Nonelectric Machinery	311.7	10.9	337.5	8.3
Electric Machinery	1,416.2	20.4	1,634.5	15.4
Communications and Electronics Equipment	958.6	21.3	1,096.4	14.4
Other	457.6	18.6	538.2	17.6
Transportation Equipment	714.5	6.3	808.2	13.1
Motor Vehicles	605.8	6.4	686.7	13.3
Other	108.7	6.1	121.5	11.8
Precision Machinery	158.8	18.3	167.4	5.4
Other	118.3	10.2	67.0	-43.4
Transportation, Communications and Utilities	180.3	-1.2	220.5	22.3
Total	4,560.1	12.9	5,136.6	12.6

Source: Management and Coordination Agency

Table 3: Japan's Ratio of Corporate R&D Expenditures to Gross Sales and Pretax Profits, By Industry, FY 1983-FY 1984

(in percent)

	FY 1983		FY 1984	
	Sales	Profits	Sales	Profits
Agriculture	0.26%	12.7%	0.24%	10.6%
Mining	0.66	5.0	0.68	5.1
Construction	0.54	13.9	0.48	16.7
Manufacturing	2.31	48.6	2.34	38.9
Food Products	0.70	17.5	0.60	16.8
Textiles	0.90	23.1	1.16	32.0
Pulp and Paper	0.63	10.3	0.66	9.6
Publishing and Printing	0.43	5.8	0.61	11.8
Chemicals	3.34	52.9	3.46	53.9
Industrial Chemicals and Synthetic Fibers	2.32	44.6	2.47	40.9
Oils and Paints	2.83	72.3	3.09	74.5
Pharmaceuticals	6.59	63.6	6.49	75.9
Other	3.40	47.4	3.76	54.4
Petroleum and Coal Products	0.26	11.4	0.27	12.4
Plastic Products	n.a.	n.a.	1.94	40.8
Rubber Products	2.40	57.1	2.62	55.1
Nonmetallic Mineral Products	1.82	28.6	1.96	26.8
Steel	1.60	42.5	1.52	21.1
Nonferrous Metals	1.49	42.2	1.64	44.8
Fabricated Metal Products	1.31	26.1	1.46	25.5
Nonelectric Machinery	2.57	51.6	2.59	47.3
Electric Machinery	4.70	73.3	4.55	66.9
Communications and Electronics Equipment	4.85	76.7	4.60	65.5
Other	4.40	66.9	4.45	70.0
Transportation Equipment	2.66	73.4	2.76	68.1
Motor Vehicles	2.89	84.5	2.90	71.8
Other	1.86	42.3	2.20	52.9
Precision Machinery	4.02	64.7	4.08	62.8
Other	1.40	31.3	0.92	3.2
Transportation, Communications and Utilities	1.04	6.7	0.92	7.2
All Industry Average	1.97	35.3	2.00	31.2

Source: Management and Coordination Agency

Table 4: Corporate R&D Expenditures, Top Ten for 1985

(in millions of dollars and percent)

	R&D Expenditures*	Percent Change	Share of Sales
Japan			
Hitachi, Ltd.	$1,050	12.0%	8.3%
Toyota Motor Corp.	1,018	9.1	4.0
NEC Corp.	975	15.0	11.2
Matsushita Electric Industrial Co., Ltd.	933	9.9	6.4
Nissan Motor Co., Ltd.	721	9.7	4.4
Fujitsu, Ltd.	636	18.5	10.0
Honda Motor Co., Ltd.	509	13.8	5.4
Mitsubishi Electric Corp.	449	9.3	5.6
Mazda Motor Corp.	339	17.3	5.1
Mitsubishi Heavy Industries Co., Ltd.	335	-1.6	4.3

	R&D Expenditures	Percent Change	Share of Sales
United States			
General Motors Corp.	$3,625	18.0%	3.8%
International Business Machines Corp.	3,457	10.0	6.9
American Telephone & Telegraph Co.	2,210	1.0	6.3
Ford Motor Co.	2,018	5.0	3.8
E.I. DuPont de Nemours & Co.	1,144	4.0	3.9
ITT Corp.	1,085	14.0	9.1
General Electric Co.	1,069	3.0	3.8
Eastman Kodak Co.	976	16.0	9.2
United Technologies Corp.	916	-2.0	6.1
Digital Equipment Corp.	717	14.0	10.7

*An exchange rate of Y238.53=$1.00 was used to convert the Japanese data.

Sources: Nihon Keizai Shimbun, December 11, 1985, and Business Week, June 23, 1986.

That growth has occurred at all is due to the fact that the prime minister has made science and technology one of the few exceptions to the no-increase budget rule (see JEI Report No. 16A, April 25, 1986). Nevertheless, after years of fiscal austerity, it is clear that particular ministries are gaining at the expense of others (see Tables 5 and 6). The Science and Technology Agency and the Ministry of International Trade and Industry have found their activities just as susceptible to the budget ax as any other organization. Even the near-sacrosanct Japan Defense Agency has seen the rate of its R&D expansion cut drastically.

Table 5: Japanese Government R&D Expenditures, FY 1985

(in millions of yen and percentage change)

	Science Promotion	Energy Research	Other Research	Special Research	Total
Diet	Y517	Y0	Y0	Y0	Y517
	0.0%	--	--	--	0.0%
Japan Technology Council	0	0	889	0	889
	--	--	12.8%	--	12.8%
Police Agency	847	0	0	0	847
	1.0%	--	--	--	1.0%
Hokkaido Development Agency	141	0	0	0	141
	0.0%	--	--	--	0.0%
Defense Agency	0	0	58,677	0	58,677
	--	--	31.5%	--	31.5%
Economic Planning Agency	704	0	0	0	704
	-1.6%	--	--	--	-1.6%
Science and Technology Agency	146,986	165,700	16,843	83,809	413,337
	4.4%	7.4%	-50.7%	15.6%	2.9%
Environmental Agency	8,524	0	1,655	0	10,179
	-3.3%	--	-0.8%	--	-2.9%
Land Agency	298	0	0	0	298
	*	--	--	--	*
Justice Ministry	787	0	0	0	787
	1.6%	--	--	--	1.6%
Foreign Ministry	0	2,633	3,633	0	6,266
	--	5.8%	3.9%	--	4.7%
Finance Ministry	318	0	0	578	897
	2.5%	--	--	2.9%	2.8%
Education Ministry	55,888	0	123,650	534,251	713,789
	0.9%	--	-1.0%	-0.0%	-0.1%
Health Ministry	26,333	0	1,296	6,130	33,759
	5.3%	--	1.1%	11.2%	6.1%
Agriculture Ministry	59,539	0	1,727	0	61,266
	1.9%	--	-2.9%	--	1.8%
International Trade and Industry Ministry	59,069	4,407	10,147	119,563	193,186
	-1.0%	-16.2%	-2.1%	24.3%	12.7%
Transportation Ministry	11,400	0	524	1,383	13,306
	-23.2%	--	-0.1%	73.1%	-17.7%
Posts and Telecommunications Ministry	4,209	0	49	10,000	14,258
	-5.7%	--	-29.2%	*	214.4%
Labor Ministry	585	0	1	2,233	2,819
	-0.6%	--	-10.0%	-30.9%	-26.2%
Construction Ministry	4,915	0	271	0	5,185
	3.4%	--	-76.1%	--	-11.9%
Home Rule Ministry	515	0	0	0	515
	0.4%	--	--	--	0.4%
Total	381,575	172,739	219,361	747,947	1,521,622
	1.3%	6.6%	-2.4%	4.9%	3.0%

*New allocation

Source: Management and Coordination Agency

Table 6: Japanese Government R&D Expenditures, Planned FY 1986

(in millions of yen and percentage change)

	Science Promotion	Energy Research	Other Research	Special Research	Total
Diet	Y517	Y0	Y0	Y0	Y517
	0.0%	--	--	--	0.0%
Japan Technology Council	0	0	863	0	863
	--	--	-2.8%	--	-2.8%
Police Agency	899	0	0	0	899
	6.1%	--	--	--	6.1%
Hokkaido Development Agency	142	0	0	0	142
	0.7%	--	--	--	0.7%
Defense Agency	0	0	66,133	0	66,133
	--	--	12.7%	--	12.7%
Economic Planning Agency	704	0	0	0	704
	0.1%	--	--	--	0.1%
Science and Technology Agency	154,277	167,708	8,497	89,860	420,342
	5.0%	1.2%	-49.7%	7.2%	1.7%
Environmental Agency	8,320	0	0	0	8,320
	-2.4%	--	--	--	-2.4%
Land Agency	210	0	0	0	210
	-29.8%	--	--	--	-29.8%
Justice Ministry	808	0	0	0	808
	2.7%	--	--	--	2.7%
Foreign Ministry	0	2,578	4,017	0	6,594
	--	-2.1%	10.6%	--	5.2%
Finance Ministry	329	0	0	610	938
	3.2%	--	--	5.5%	4.7%
Education Ministry	57,745	0	124,807	563,039	745,591
	3.3%	--	0.9%	5.4%	4.5%
Health Ministry	28,015	0	1,251	6,856	36,121
	6.4%	--	-3.5%	11.8%	7.0%
Agriculture Ministry	60,733	0	1,944	3,800	66,477
	2.0%	--	12.6%	*	8.5%
International Trade and Industry Ministry	56,427	3,404	10,675	147,050	217,557
	-4.5%	-22.7%	-0.9%	18.2%	9.5%
Transportation Ministry	11,511	0	571	1,188	13,271
	1.0%	--	-0.6%	2.0%	1.0%
Posts and Telecommunications Ministry	4,126	0	41	20,500	24,667
	-2.0%	--	-16.1%	105.0%	73.0%
Labor Ministry	599	0	1	2,371	2,970
	2.4%	--	0.0%	5.8%	5.1%
Construction Ministry	5,065	0	751	0	5,817
	3.1%	--	177.5%	--	12.2%
Home Rule Ministry	527	0	0	0	527
	2.5%	--	--	--	2.5%
Total	390,954	173,690	219,551	814,773	1,598,969
	2.5%	0.6%	0.5%	8.3%	4.8%

*New allocation

Source: Management and Coordination Agency

A careful examination of government-sponsored research programs reveals a mixed pattern, as each ministry sets its own priorities (see Table 7). MITI reports that some of its projects are in the process of being shifted to the private sector, which accounts for some cuts, but even its treasured Next Generation Basic Technology program is being pared in fiscal 1986. All bodies except the Science and Technology Agency seem to be focusing consistently on applied projects, despite numerous advisory council and ministry reports advocating more funding for basic research.

Table 7: Expenditures on Selected Science Programs, by Agency, FY 1985-FY 1986

(in millions of yen)

	FY 1985	FY 1986
Defense Agency		
Technology development	Y57,819	Y65,259
Science and Technology Agency		
Agency research (including four air and space development organizations)	23,245	25,125
Physical Chemistry Research Institute	11,096	13,793
New Technology Development Association	1,756	1,737
Science and technology promotion survey	4,203	4,514
Space Development Association	88,861	90,659
Ocean development research	6,857	6,631
Ocean Science and Technology Center	6,700	6,437
Japan Nuclear Development Research Institute	99,674	101,556
Japan Reactor Development Center	65,769	65,925
National Nuclear Research Laboratory	1,733	1,774
International technology cooperation	9,241	0
Research management costs	7,602	8,497
Environment Agency		
National Disaster Research Institute	4,361	4,266
National Water-borne Disease Center	425	426
National Disaster Prevention Institute	2,765	2,625
Disaster prevention survey	884	883
Foreign Ministry		
International Atomic Energy Commission	2,633	2,578
OECD Nuclear Power Committee	179	181
Finance Ministry		
Brewing Research Institute	318	329
Education Ministry		
Ministry research (including six education centers)	6,531	6,680
Research grants	42,000	43,500
Japan Technology Promotion Council grants	3,480	3,781
Health Ministry		
Agency research (including seven population research projects)	9,642	9,858
Research grants	11,870	12,860
Radiation effects research	1,862	1,946
Health science research	2,448	2,842
Cancer research projects	1,388	1,388
International cancer research	213	132
Medical and drug information system	246	263

Agriculture Ministry		
Agency research laboratories (including 18 agricultural research centers)	Y43,437	Y44,547
Agricultural technology development	9,308	9,370
Large-scale projects	1,444	1,366
Biotechnology development	1,058	1,241
Research machinery and equipment	2,066	2,066
Agricultural technology promotion	2,090	2,090
Agricultural machinery research	Y788	Y810
Red tide research	226	224
Food product technology	385	602
International Trade and Industry Ministry		
Agency research (including 15 research centers)	24,252	25,176
Large-scale industrial technology projects	7,698	5,275
Computer industry promotion projects	4,779	4,501
Next generation basic technology projects	6,445	5,644
Key technology research and development	1,284	0
New energy technology projects	3,022	2,378
Energy conservation projects	1,385	1,026
Private transportation project (YXX aircraft)	1,371	714
Private aircraft jet engine project	3,829	3,987
Small business technology improvement	1,397	1,397
Transportation Ministry		
Agency research (including four ship technology centers)	7,122	7,168
Geostationary weather satellite management	1,829	2,032
Geostationary weather satellite launches	2,306	2,167
Magnetic levitation train technology	300	300
Posts and Telecommunications Ministry		
Electrotechnical laboratories	4,209	4,126
Construction Ministry		
Agency research (including one engineering center)	4,305	4,435

Source: Management and Coordination Agency

Sowing R&D Seeds

Like a modern-day Johnny Appleseed, MITI is trying to spread the reach of high technology deep into the countryside. The centerpiece of these efforts is the Technopolis regional development program. Initiated in 1981 and implemented at the start of fiscal 1984, it called for the development of 14 regional centers by the year 2000. The program has been attacked by critics who assert that it is merely a coordinated advertising campaign for local investment. In response, MITI added a new "research core" program for fiscal 1986 that builds on the Technopolis concept with 28 new local technology centers. The focus of the centers will be purely technological -- conducting research, training researchers, and transfering the technology to local businesses -- as opposed to the general development goals of the Technopolis program. MITI is not committing much money to the new program, but will use tax incentives to attract private investment.

MITI's Small Business Agency will join the regional research effort this year with its Technology Pioneer and Local Technology Development programs.

The Technology Pioneer plan aims at expanding the use of robots and computer-aided design/computer-aided manufacturing (CAD/CAM) techniques in small companies. A wide range of applications is expected, including software development, integrated circuit design, light manufacturing, biotechnology and new materials. The Local Technology Development effort has targeted eight prefectures for specific projects ranging from faster integrated circuit layout to improving noodle production techniques.

Other ministries and agencies also have regional development plans or are considering such steps. The most significant to date is the Ministry of Education's efforts to establish community colleges that focus on high technology. These national engineering schools offer courses in the following fields: energy, production systems, electrical and electronic engineering, materials, regional planning, and information and computer science. They also sponsor technology development centers that serve as direct links with local businesses, providing technical advice, new technology and coordinating joint research. Industry researchers are also welcome to participate in commissioned research projects.

Problems and Outlook

While everything may seem rosy, Japan still faces some significant hurdles to developing a balanced research and development environment. Tokyo set out six years ago to emphasize basic research, a policy that has yet to have a visible impact. Everyone talks about the importance of basic research, but funds have been only gradually moved toward this area. The shifting funding balance between the public and private sectors is likely to exacerbate this sluggish trend. While Japanese corporations recognize the importance of basic research to industry leadership, it is still difficult for them to divert money from product development. This would seem to argue for an increased role in basic research by the government. Unfortunately, budget restrictions and entrenched programs make a rapid shift to this focus nearly as difficult.

The second major problem that Tokyo is only slowly addressing is the relationship between academia and private industry. Despite efforts to create research consortia with scientists from both groups, avenues of contact remain quite limited. Industry is willing, if not anxious, to sponsor research at universities and cooperate in joint projects, but the Ministry of Education and rigid university procedures have blocked progress.

MOE limits the number of private researchers working in national university laboratories. Why the ministry follows this policy is not clear. If a Japanese company is lucky enough to gain MOE's permission to place a scientist in such a lab, it must pay a research fee to the ministry as well as foot the bill for all research costs. The alternative is to persuade a university professor to invite an industry-sponsored scientist to participate in a project. In this case, MOE's permission is not required, but the application must run the gamut of university faculty politics to gain departmental approval. The cost of this route is lower since no fee is paid to MOE.

A solution to the industry-academia research problem has been overshadowed by the heated debate over the basic shape of the educational system. Despite Prime Minister Nakasone's determination to push for reform, it could be

some time before Japanese university and private scientists can meet in as open an environment as in the United States.

To compensate for these two weaknesses, Japan is taking advantage of academic research in the United States. The number of Japanese researchers and students working in this country has been growing steadily over the past several years. American subsidiaries of Japanese corporations are exploring links with universities across the country. Clearly, Japanese companies are seeking to capitalize on the mature U.S. basic research infrastructure while they slowly build up their own. Just as clearly, the U.S. scientific community benefits from the presence of meticulous Japanese researchers and the deep pockets of Japanese firms.

The situation presents some delicate questions. Is there a truly reciprocal flow of technology? Are we mortgaging our technological future by allowing foreign scientists to tap our best research? The answer to these questions is being debated in Washington. Tokyo is trying to reduce tensions by sponsoring more joint research and launching new international research projects. Whether this will be enough remains uncertain. The potential for an anti-Japanese backlash is clear. Such a reaction, however, would also harm the U.S. R&D effort. The two nations have become very interdependent in terms of technology, and policymakers are just beginning to deal with this reality.

In the meantime, Japan's domestic research efforts will continue to grow at a healthy pace, due primarily to spending by private industry. While Japan's research community may be short on basic research, it is not lacking in forward vision. Technological innovation and progress will continue to be embodied in Japanese products, which can be expected to maintain their global appeal.

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The views expressed in this report are those of the author and do not necessarily represent those of the Japan Economic Institute.